

These insects continued throughout the month, whenever the weather was warm and calm enough to permit of their flight, and at the close of the month another lot preserved showed the same preponderance of *hirticula* and *arcuata* and about the same relative proportion of *micans*, but instead of *fraterna* a single specimen of *hirsuta* was taken. Thus during the month of May these species occurred simultaneously and continuously.

By carefully picking off and shaking down two or three times between 8 and 11 o'clock, I had no great difficulty in substantially preserving the foliage of the trees named. During the present month there will undoubtedly be a sequence of the species, but in far less abundance and with no essential injury to the foliage. I have a suspicion that the habit which our oaks, in the District at least, manifest, of putting out a secondary vigorous growth in the month of June or later, has been acquired as a consequence of the very general eating-off of the terminal young growth in the beginning of the season by *Lachnosterna*. How very difficult these insects are to deal with when the question is one of a large number of trees has been indicated the present spring by the experience of Mr. D. H. Rhodes, who has charge of the tree-planting in the grounds at Arlington. He had a very large number of young maples set out from the nursery and very many of them have been ruined by these beetles, and the measures he could adopt failed to prevent their onslaught.

I had a curious experience with the first lot I preserved. They were thrown into an old cyanide bottle, the cork of which was not very tight, and the cyanide in which was more or less inoperative. The bottle was lined with blotting-paper and the beetles—just exactly two dozen specimens—chewed the paper up into a triturated mass, some of them retaining life up to the third week. This was a rather singular experience, considering that in empty bottles the beetles would perish in as many days, and I have little doubt that the blotting-paper saturated with cyanide and thus kept moist helped to preserve life in these insects in this instance, a result which one would hardly have anticipated from its well-known deadly effects upon insects generally.

#### NOTES ON COCCIDÆ.

By C. V. RILEY, Ph. D.

##### MODE OF HIBERNATION—EFFECTS OF SEVERE COLD—VIVIPARITY—REMEDIES.

General experience indicates that most of our Coccidæ hibernate in the egg state, yet there is no uniform rule in this respect and I have been somewhat interested the past year in noting the hibernating habits of a few species that have come under my own

notice. *Chionaspis euonymi*, which has been extremely injurious to the *Euonymus japonicus* in this city, and which attacked certain fine plants in my own garden, is a difficult species to deal with by virtue of the fact that it is so irregular in breeding. Last year I became aware of its occurrence on my own plants too late to deal with it effectually. Experiments made during the autumn and winter of 1892-'3 with the ordinary kerosene emulsion 4 or 5 times diluted only destroyed but a small portion of the mature females, but a much larger proportion of the immature scales. A curious thing about this particular species is that there is continuous hatching throughout the summer at no regular intervals, and that even as late as frost larvæ will be still hatching. Moreover, the females hibernate in various stages of development. No eggs will be found under the females during winter, and one might almost be led to suppose that it is viviparous. From about the middle of May, however, the eggs begin to be produced, a few only from each female, and these continue to hatch over quite a period.

An experience which I had last summer is interesting as indicating the migratory power of the young larvæ. I had planted in the spring a vigorous specimen of *Euonymus scandens* against the stone wall of my front porch. This is about ten feet from the nearest standard *Euonymus* which was infested, and there is a flower bed nearly three feet wide, besides three strips of grass sod, and a gravel walk four feet wide between the two. I know that the young *Euonymus scandens* was perfectly free from insects, and yet by midsummer I noticed that the insects swarmed upon it—so much so that it was practically killed down this past winter. The young larvæ must have persistently crawled this distance, a large number of them reaching the climbing *Euonymus*—whether instinctively wending their way in that direction or whether others were scattered in all directions and lost I did not ascertain. It is very doubtful if they could have been carried over in such numbers by other insects, especially as ants are seldom seen on the *Euonymus*, and that the wind played no part in the distribution may be justly inferred from the fact that the climbing plant was in a northwesterly direction from the other, a direction in which the winds are rare in summer, as they are far more often from the west or southwest or else from the north.

The Maple Scale, *Aspidiotus tenebricosus*, was exceedingly abundant two years ago and, as many of the members are aware, the Park Commissioners severely pruned and cut down many of the trees along some of our principal streets and whitewashed the trunks, with a view of checking or destroying it. This treatment, as I know from examinations made both by others as well as myself, did not kill the insects, as they continued to breed last year on all the new growth. Observations on this species also

indicate that it is viviparous and hibernates in the mature female form. The most interesting fact connected with it, however, is that the very severe and exceptional cold of last winter seems to have killed it out, as, so far, Messrs. Pergande, Schwarz, and Chittenden, who have examined the subject for me, report that they have found no living specimens.

In this connection I may also give a little experience with *Chionaspis furfurus*, the well-known Scurfy Scale of *Pyrus* trees. This proved in my own garden extremely fatal to a hedge of *Pyrus japonica*, when allowed to multiply, and experiments with kerosene emulsion only  $\frac{1}{2}$  diluted showed that comparatively few of the perfect scales in autumn or winter, while the leaves are off the plant, are destroyed by it. It becomes necessary, therefore, to attack it in the young or newly hatched larva state. Fortunately the larvæ hatch quite uniformly about the middle of May, and the kerosene emulsion diluted in 5 times its bulk of water proved, when carefully applied, thoroughly effectual, without any injury to the plants. Where, however, it was repeated two or three times upon the same plant it caused a dropping of the foliage and a blackening of the more tender growth, yet the plants are not materially injured and will undoubtedly put forth fresh shoots and foliage. But a single treatment has been effectual in killing every individual scale.

In connection with the hibernation of the species mentioned I have been led to go over my own earlier records on the hibernating habits of the family, as also over the records of the Division of Entomology. I have compiled the facts contained in Prof. Comstock's article in his own report as U. S. Entomologist for 1880. From these data it will appear that no general rule can be formulated, and that we not only have species in the same sub-family hibernating either as larvæ or in stages intermediate between the larva and adult, but in the adult female form and in the egg, and that some species will be found in all these different stages of development during the winter. The fact remains, however, that in the armored scales the great majority, in more northern latitudes, hibernate in the egg state.

#### SUMMARY OF RECORDS.

*Diaspinæ*.—*Aspidiotus obscurus* Comst.—On *Quercus phellos*. The notes indicate that in the District of Columbia this species hibernates in both the larva and adult states. No eggs have been observed.

*Aspidiotus tenebricosus* Comst.—Maples; D. C. Viviparous; hibernates as adult female.

*Aspidiotus perniciosus* Comst.—On Apple and a number of other deciduous fruit trees; California. Specimens examined in December, 1879, showed that the mature females were hibernating, and that with some of them were found a few eggs and recently hatched larvæ. There

were also younger females in different stages of development. Others examined October, 1880, showed that all the females were living and that the younger larvæ were present, but no eggs were found. The species thus seem to hibernate in the mature female condition and to be both oviparous and viviparous.

*Aspidiotus aurantii* Mask.—Cal. Both oviparous and viviparous; Hibernates as adult female.

*Aspidiotus rapax* Comst.—On Euonymus, Orange, etc.; Florida and California. Observations made from March to the end of June indicate that this species hibernates in the adult female, in the egg state, or as recently hatched larvæ.

*Aspidiotus sabalis* Comst.—On Palmetto; Florida. The records indicate that this species hibernates both in the adult female and larva states. Mature males were also observed March 23, 1883, but no eggs are recorded.

*Aspidiotus ancylus* Putn.—On various species of trees; District of Columbia. Hibernates as half-grown female and as male larva, the male appearing in March and April; eggs unknown.

*Aspidiotus*, n. sp.—On Camellia; California. Hibernates in the adult state, but numerous eggs are found the latter part of the winter.

*Aspidiotus*, n. sp.—On Japanese tea-plant; California. Hibernates in the adult female state, the eggs being produced the latter part of the winter.

*Diaspis boisduvalli* Sign.—On Livingstonia; D. C. Adult females with eggs and younger females in different stages, male pupæ and adult males, were all observed as late as November 12.

*Diaspis lanatus* Morg. and Cckl.—On Peach; Florida. Mature females hibernate without eggs; eggs are, however, found during the latter part of June, probably of the second generation.

*Diaspis rosæ* Sandb.—On Rosæ, etc.; D. C., Florida, California. Specimens received from Florida February 20, 1880, embraced adult and partly grown females, adults with numerous eggs, some of which were hatching. Males were at the same time swarming. By April 20 adult females and eggs were still present, though the males were absent. Specimens of the same species received from California February 7, 1881, showed that the females were about half-grown and the males fully developed. The same species from Washington, examined March 6 of this year (1893), showed adult and half-grown females, the majority, however, being in the egg state.

*Diaspis carueli* Targ.—On Juniperus, etc.; D. C. Hibernates in the adult female state, no eggs having so far been found.

*Chionaspis pinifolii* Fitch.—On Pine. Oviparous; hibernates in the egg state.

*Chionaspis biclavis* Comst.—On Camellia; D. C. Oviparous; appears to be a continuous breeder.

*Chionaspis quercus* Comst.—On Oak; California. Oviparous; hibernates as partly grown female, or as adult female, though the male larvæ and pupæ have been observed as late as August.

*Chionaspis fraxini* Sign.—On Ash; England. Oviparous; hibernates in the egg state.

*Chionaspis*, n. sp.—On Black Cherry; New York. Oviparous; hibernates in the egg state.

*Chionaspis*, n. sp.—On Cornus; D. C. Probably hibernates in the adult female form. Specimens examined June 9, 1881, contained numerous eggs.

*Chionaspis*, n. sp.—On Dwarf Apricot; Japan. Oviparous; hibernates in the egg state.

*Mytilaspis*, n. sp.—On *Myrtus barometrica*; D. C. Oviparous; hibernates in both egg and larva state.

*Mytilaspis*, sp.—On *Ulmus purpurea*; D. C. Oviparous; hibernates in the egg state.

*Mytilaspis*, n. sp.—On Yucca; D. C. Oviparous; hibernates in the egg state.

*Mytilaspis*, n. sp.—On *Camellia japonica*; Georgia. Oviparous; probably hibernates in the egg state, as eggs were found as late as August 25.

*Mytilaspis*, n. sp.—On *Celastrus scandens*; Virginia. Oviparous; probably hibernates in the egg state, these being found late in summer.

Lecano-diaspini.—*Asterodiaspis quercicola* Bouché.—D. C.; hibernates in the adult female state; eggs not observed.

*Asterodiaspis pustulans* Cockl.—On Hibiscus, etc.; Florida. Oviparous; hibernates in the egg state.

Lecaniini.—*Ceroplastes floridensis* Comst.—On Orange, etc.; Florida. Oviparous; hibernates as adult; eggs hatching from middle of February until end of April.

*Ceroplastes cirripediformis* Comst.—On Orange, etc.; Florida. Oviparous; winter habit not observed.

*Lecanium hesperidum* Linn.—On various plants; D. C. Viviparous; breeds continuously.

*Lecanium platyceri* Pack.—On *Platycerum alcicorne*; D. C. Viviparous; hibernates as adult female, though a few recently produced larvæ were noticed in December. Probably breeds continuously.

*Lecanium tulipiferæ* Cook.—On Magnolia, etc.; Florida; D. C. Viviparous. At Washington the species hibernates in the larva state; in Florida all stages have been observed during the winter.

*Lecanium hemisphericum* Targ.—On various plants; D. C. Oviparous; hibernation not noticed.

*Lecanium oleæ* Bern.—On various plants; D. C. Breeds continuously.

*Lecanium*, sp.—On *Acacia decurrens*; D. C. Viviparous; larvæ of all stages were observed as late as December 8, 1880.

*Lecanium*, sp.—On Red Bay, *Persea carolinensis*; Florida. Viviparous; hibernates as adult.

*Lecanium*, sp.—On Elm. Oviparous; hibernates as partly grown larva.

*Lecanium*, sp.—On Fraxinus; D. C. Oviparous; hibernates as larva.

*Lecanium*, sp.—On Grape; California. Oviparous; hibernates as adult female.

*Lecanium*, sp.—On *Celtis*; D. C. Oviparous; hibernates as larva.

*Lecanium*, sp.—On Mesquite; Arizona. Appears to be viviparous; numerous larvæ were issuing from scales received June 20, 1882.

*Lecanium*, sp.—On Osage Orange; Utah. Oviparous; winter habit not observed.

*Lecanium*, sp.—On Oak; D. C. Probably hibernates as partly grown larva.

*Lecanium*, sp.—On *Quercus laurifolia*; Alabama. Oviparous; dead females filled with eggs received April 18, 1881.

*Lecanium*, sp.—On Pear; California. Oviparous; hibernates in the egg state.

*Lecanium*, sp.—On Peach; D. C. Oviparous; hibernates in the imago state.

*Lecanium*, sp.—On *Sagaretia michauxii*; So. America. Oviparous; hibernates probably in the imago state; scales filled with eggs examined May 1, 1885.

**Pulvinariini.**—*Pulvinaria innumerabilis* Rathv.—This and all other species of the subfamily studied are oviparous and hibernate in the partly grown female state. In Florida the females commence ovipositing in March, while further north oviposition does not take place until May.

**Kermesini.**—*Kermes galliformis* Riley.—On Oak; widely distributed. Oviparous; mode of hibernation not positively ascertained, though probably as adult females.

*Kermes*, sp.—On *Quercus obtusiloba*; Texas. Oviparous; hibernates probably in adult female, eggs hatching being received May 17, 1882.

*Kermes*, sp.—On *Quercus niger*; Missouri. Oviparous; hibernates in the larva state.

*Kermes*, sp.—On *Quercus tinctoria*; New York. Oviparous; hibernates probably as larva.

*Kermes*, sp.—On Live Oak; California. Oviparous; hibernates in larva state.

*Kermes*, sp.—On *Quercus obtusiloba*; Texas. Oviparous; hibernates probably as adult female, as larvæ were just hatching May 18, 1882.

**Dactylopiini.**—*Dactylopius destructor* Comst.—On Orange, etc.; Florida. Oviparous; breeds continuously.

*Dactylopius*, sp.—On Roots of Clover. Oviparous; hibernates in adult and egg states. Taken June 10, 1880; eggs hatched from January 31 to February 3.

*Dactylopius longifilis* Comst.—On hot-house plants; D. C. Viviparous; breeds continuously.

*Dactylopius*, sp.—On Maple. Oviparous; hibernates in the egg state. Dead females and eggs found March 16, 1881; larvæ hatched March 28.

*Dactylopius*, sp.—On Sycamore; D. C. Oviparous; hibernates in partly grown larva state. Dead females and eggs were found September 18, 1873; eggs hatched September 23.

*Dactylopius*, sp.—On grass; D. C. Oviparous; hibernates apparently

in all stages. Adult females, eggs, and immature specimens in all stages were found October 22, 1881.

*Acanthococcini*.—*Cerococcus quercus* Comst.—On Oak; Arizona. Oviparous; hibernates in the egg state. Scales received January, 1874, contained numerous eggs, which commenced hatching March 18, 1874.

*Gossyparia ulmi* Groff.—On Elm; D. C. This species appears to be oviparous and hibernates in the larva state.

*Eriococcus azaleæ* Comst.—On Azalea; D. C. Oviparous; hibernates in all stages.

*Rhizococcus quercus* Comst.—On Live Oak; Florida. Oviparous; hibernates in all stages. Among specimens received March 29, 1882, were mature females, partly grown females, young larvæ, eggs, and fully developed males, which seems to indicate that there are two or more generations each year.

*Rhizococcus araucariæ* Comst.—On Araucaria; California. Oviparous; the eggs were probably deposited in August or September. It hibernates probably as partly grown larva.

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In discussing these several communications Mr. Doran stated that at one time he had kept a Scarabæid beetle for five days in a bottle containing fresh cyanide, and that at the expiration of this time it was apparently as healthy as ever. Mr. Schwarz stated that in his opinion the species of *Lachnosterna* are much longer lived than supposed by Prof. Riley. Instead of dying in three or four days, he thinks that they normally live for several weeks. Dr. Marx stated that on May 10 he received a male and female *Centrurus vittatus* from Baltimore and placed them separately in dry bottles. The male died in five days, but the female is still alive, having given birth to numerous young. In this case the longevity is plainly influenced by maternity. Mr. Howard thought that the influence of Prof. Riley's cyanide was far from being proven, and suggested that if the check bottles had contained an equal amount of moistened blotting-paper the comparative results might have been different. In regard to the instance of the travelling of the young of the *Chionaspis*, he thought that this was rather to be explained by the accidental portage of many individuals by flying insects and by English sparrows, everywhere so abundant. Mr. Ashmead stated that from observations in Florida he was convinced that ants have a great influence in the carriage of bark-lice to a distance. Prof. Riley stated that no